Herbicide Efficacy and Selectivity on Native Tree and Shrub Seedlings

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Successful establishment of native tree and shrub seedlings is a critical first step towards restoration of bottomland and riparian forests. Invasive weeds must be controlled before and after planting or seedling survival will suffer. Many approaches can be used, but herbicides are an efficient and cost-effective approach to control weeds and limit competition. Best results come from a combination of foliar herbicide to kill growing weeds, and a soil-active herbicide to prevent re-establishment of weeds. While there are a number of soil-active herbicides safe and labeled for use on conifers in forests, there are no soil-active herbicides for use on hardwoods. This causes repeated and costly hand applications of foliar herbicides such as glyphosate or hand weeding to maintain effective control. The objective of this study was to evaluate common preemergent herbicides with low environmental impact to determine which might be suitable for restoration applications with hardwood species.

Methods

Products of interest were selected based on predicted efficacy as a preemergence herbicide in restoration sites and potential impact on non-target organisms. Products were then evaluated for crop safety and efficacy at two sites. Plots were established on irrigated (OSU Research Farm) and nonirrigated sites (Half Moon Bend). Glyphosate (2 lb ae/A) was applied to control surviving winter weeds before planting trees and shrubs. Cottonwood (*Populus balsamifera* L. *trichocarpa,* POBAT), ninebark (*Physocarpus capitatus* (Pursh) Kuntze, PHCA11), redosier dogwood (*Cornus sericea* L., COSES), ash (*Fraxinus latifolia* Benth., FRLA), and snowberry (*Symphoricarpos albus* (L.) Blake, SYAL) were acquired from local native plant nurseries.

Bareroot trees and seedlings (18 to 36 in tall) were planted by hand on May 8, 2012 in rows 5 ft apart and in plots 15 ft long within a randomized split-plot design with 4 replications. After trees and shrubs were planted, water was applied to settle the soil around each plant using irrigation (at OSU research farm) and a hose (1 gal/plant) at the nonirrigated site (Half Moon Bend). Preemergence herbicides were applied as a directed-application to plots after watering. Plots were mowed mid-July (at both sites) and rototilled between rows (at the irrigated site; OSU Research Farm) to reduce competition from weeds. Tree growth, survival, and weed control were monitored throughout the summer. Electric fence was installed but did not eliminate all grazing by deer at Half Moon Bend.

Results and Discussion

Flumioxazin provided excellent preemergence weed control with low risk of injury to transplants at both sites (Tbls. 2 and 3). Weed competition in the untreated plots at Half Moon Bend curtailed tree and shrub growth (Fig. 1) and caused on average 41% mortality of trees and shrubs (65% of redosier dogwood 17% of snowberry). Initial results indicate that of eight herbicides screened, flumioxazin is the best fit based on efficacy, crop safety and environmental toxicology. Flumioxazin provided near complete suppression of emerging weed seedlings, and significantly improved tree survival by the end of summer.

Table 1. Herbicide application data.

	OSU RESEARCH FARM	HALF MOON BEND
Date	May 10, 2012	May 20, 2012
Crop stage	2DAP	10DAP
Herbicide/treatment	PRE	PRE
Start/end time	6:15-7:30 AM	7:30-8:30 AM
Air temp/soil temp (2")/surface	59/48/48	60/-/-
Rel humidity	48%	90%
Wind direction/velocity	0-1 NE	0
Cloud cover	0	100
Soil moisture	Dry except where holes were dug	Damp
Plant moisture	Dry	Damp, few sprinkles of rain
Sprayer/PSI	BP30	BP30
Mix size	2100 ml/ 2 plots	6000 mls
Gallons H20/acre	20	20
Nozzle type	2-XR-8003	3-XR-8003
Nozzle spacing and height	20/20	20/20
Soil inc. method/implement	Irrigated next day with 0.5 in of water	Rain coming, expect more than 0.5 in in next 3 days

Table 2. Mean phytotoxicity ratings (0-10, 10=dead) for herbicide effects on five native species planted at the irrigated site (OSU Research Farm).

Treatment		Rate	Phytotoxicity ratings 29 May 2012					Weed control 31 Jul
		lbs ai/A	Ave. composite rating (0-100)	Pacific ninebark (PHCA11)	Oregon ash (FRLA)	Redosier dogwood (COSES)	Snowberry (SYAL)	Ave. composite rating (0-100)
1	flumioxazin	0.3825	0.1	0.1	0.0	0.1	0.0	88.8
2	indaziflam	0.065	0.1	0.0	0.0	0.5	0.0	90.0
3	prodiamine	1.5	0.0	0.3	0.0	0.1	0.3	67.5
4	rimsulfuron	0.0625	0.0	0.3	0.0	0.1	0.0	55.0
5	saflufenacil	0.044	5.3	3.0	0.0	0.6	0.3	57.5
6	mesotrione	0.1875	0.0	2.5	0.3	0.8	0.5	46.3
7	isoxaben	1.0	0.0	0.0	0.0	0.4	0.0	25.0

Table 3. Mean phytotoxicity ratings (0-10, 10=dead) for herbicide effects on five native species planted at the non-irrigated site (Half Moon Bend).

Treatment		Rate	Phytotoxicity ratings 29 May 2012					Weed control 17 Jul
		lbs ai/A	Black cottonwood (POBAT)	Pacific ninebark (PHCA11)	Oregon ash (FRLA)	Redosier dogwood (COSES)	Snowberry (SYAL)	Ave. composite rating (0-100)
1	flumioxazin	0.3825	1.5	2.0	0.5	0.3	2.0	96.5
2	indaziflam	0.051	0.8	2.8	1.8	0.5	0.1	83.8
3	prodiamine	0.0	0.0	0.0	0.0	0.3	0.3	68.8
4	isoxaben	0.5	0.5	0.5	0.3	0.0	0.0	57.5

Figure 1. Untreated check on left and flumioxazin on right. Note difference in tree growth and survival.